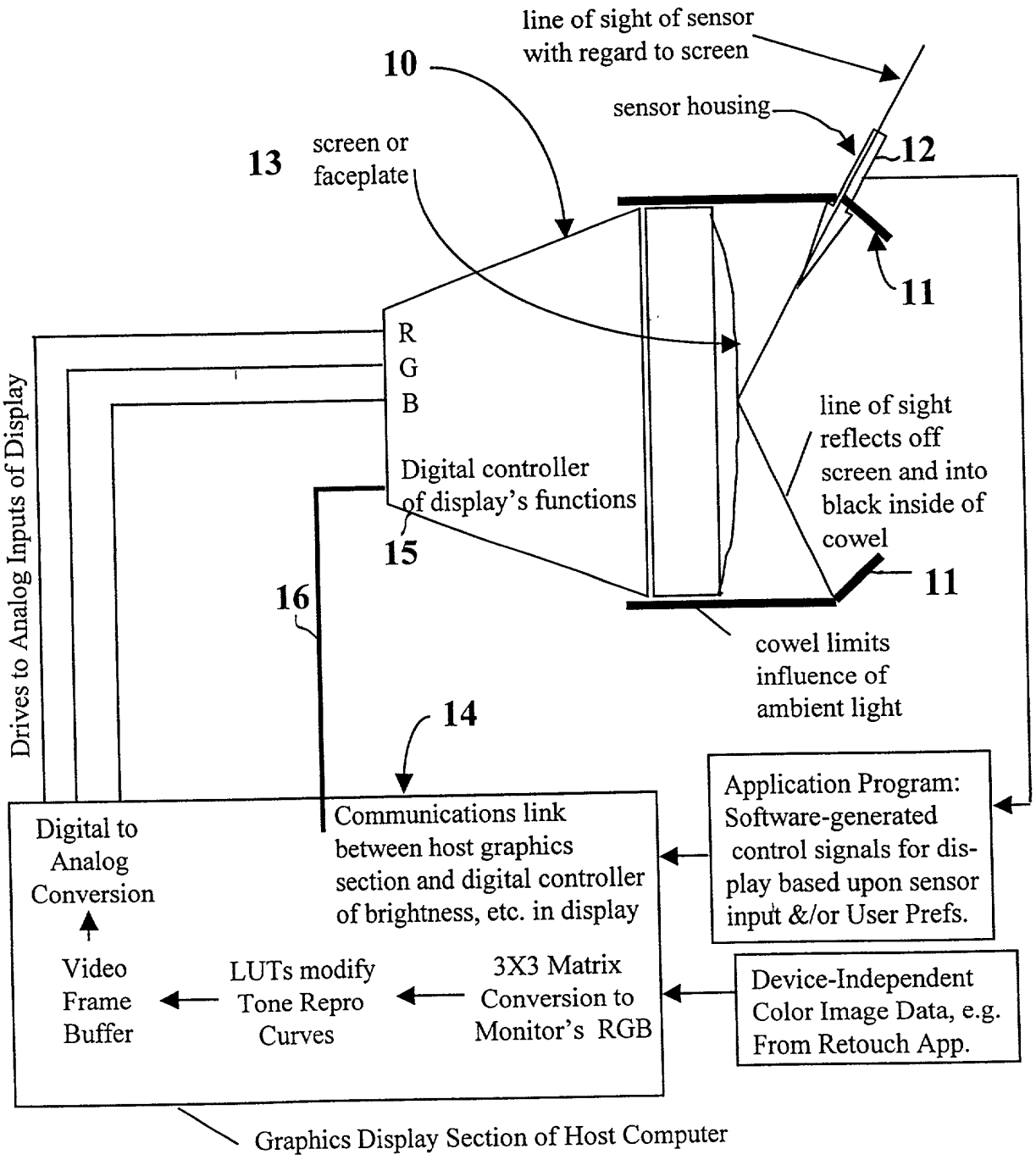
line of sight of sensor
with regard to screen
10
sensor housing
12
13
screen or
faceplate
11
R
G
B
line of sight
reflects off
screen and into
black inside of
cowel
Digital controller
of display's functions
15
11
16
cowel limits
influence of
ambient light
Drives to Analog Inputs of Display
14
Application Program:
Software-generated
control signals for dis-
play based upon sensor
input &/or User Prefs.
Digital to
Analog
Conversion
Communications link
between host graphics
section and digital controller
of brightness, etc. in display
Video
Frame
Buffer
LUTs modify
Tone Repro
Curves
3X3 Matrix
Conversion to
Monitor's RGB
Device-Independent
Color Image Data, e.g.
From Retouch App.
Graphics Display Section of Host Computer

FIG. 1

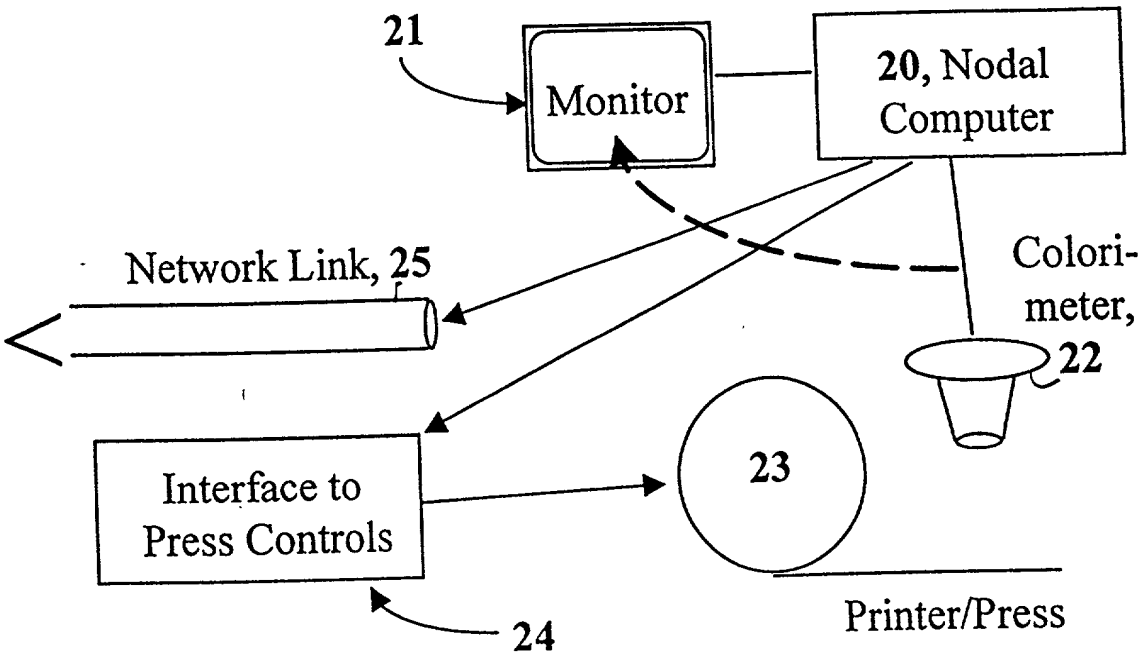
21
Monitor
20, Nodal Computer
Network Link, 25
Colori-
meter,
22
Interface to
Press Controls
23
24
Printer/Press

FIG. 2

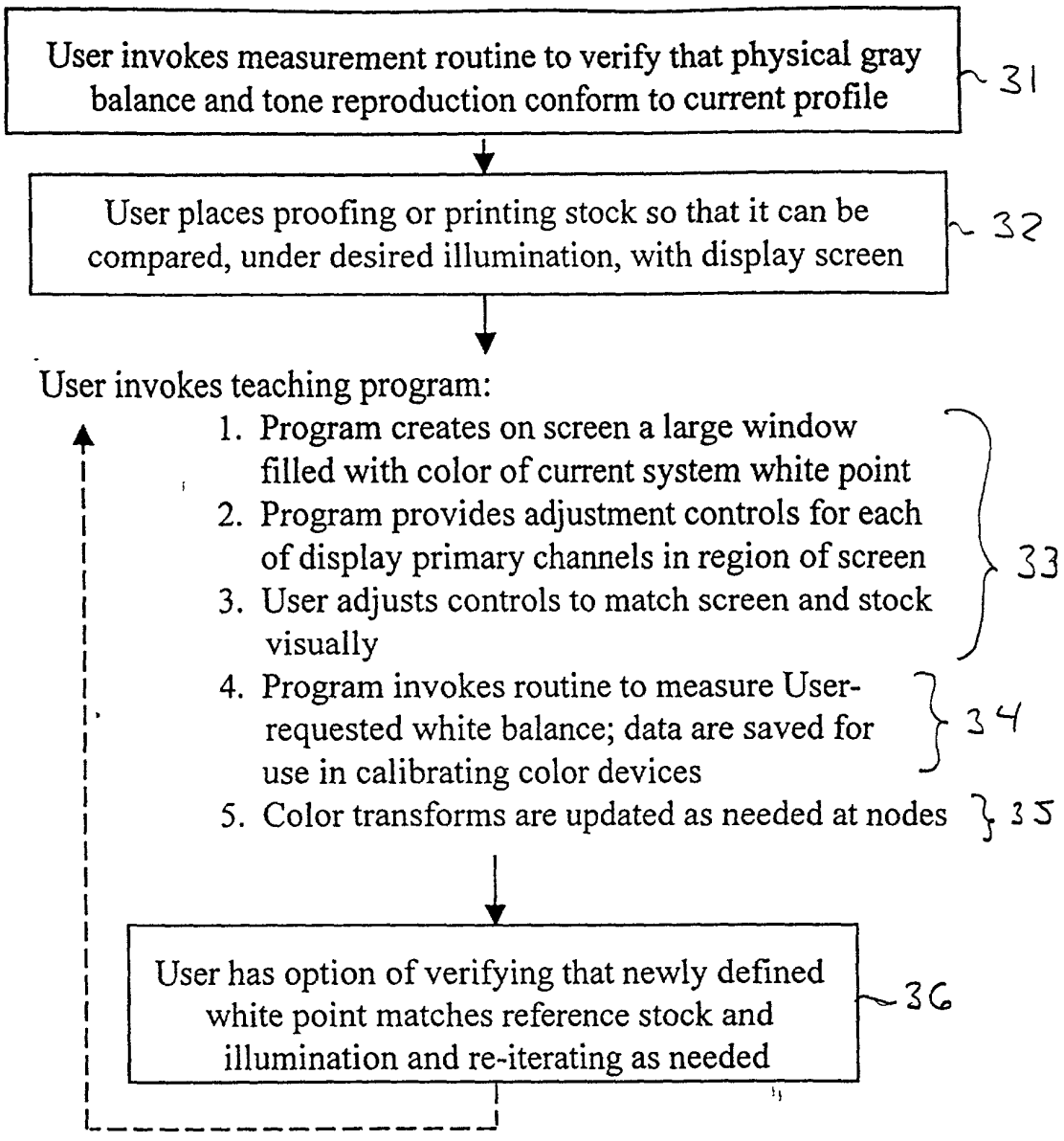
User invokes measurement routine to verify that physical gray balance and tone reproduction conform to current profile
31
User places proofing or printing stock so that it can be compared, under desired illumination, with display screen
32
User invokes teaching program:
1. Program creates on screen a large window filled with color of current system white point
2. Program provides adjustment controls for each of display primary channels in region of screen
3. User adjusts controls to match screen and stock visually
33
4. Program invokes routine to measure User-requested white balance; data are saved for use in calibrating color devices
34
5. Color transforms are updated as needed at nodes
35
User has option of verifying that newly defined white point matches reference stock and illumination and re-iterating as needed
36

FIG. 3

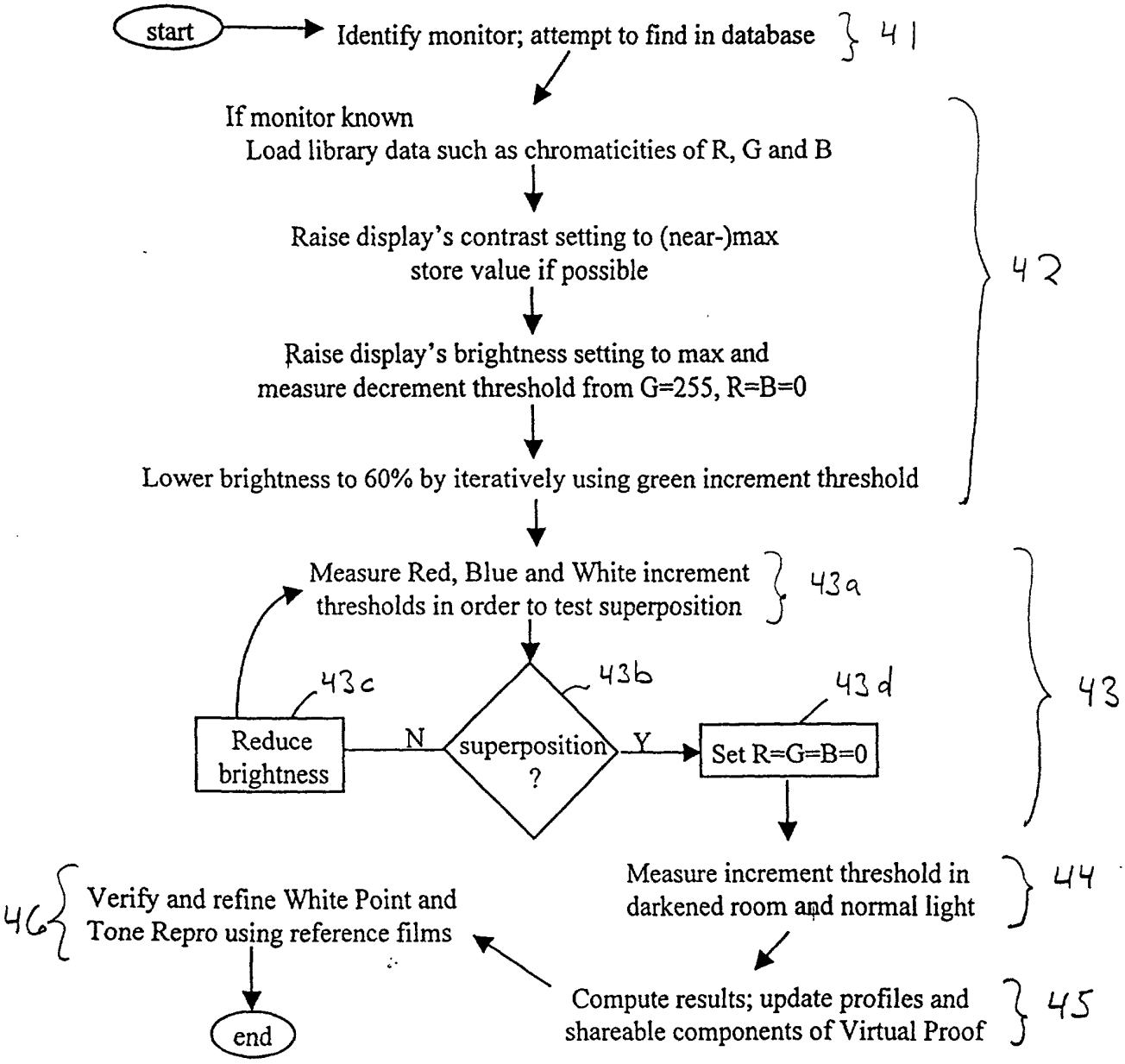
start
Identify monitor; attempt to find in database
41
If monitor known
Load library data such as chromaticities of R, G and B
Raise display's contrast setting to (near-)max
store value if possible
Raise display's brightness setting to max and
measure decrement threshold from G=255, R=B=0
Lower brightness to 60% by iteratively using green increment threshold
42
Measure Red, Blue and White increment
thresholds in order to test superposition
43a
43c
43b
43d
Reduce
brightness
N
superposition
?
Y
Set R=G=B=0
43
Measure increment threshold in
darkened room and normal light
44
46
Verify and refine White Point and
Tone Repro using reference films
Compute results; update profiles and
shareable components of Virtual Proof
45
end

FIG. 4

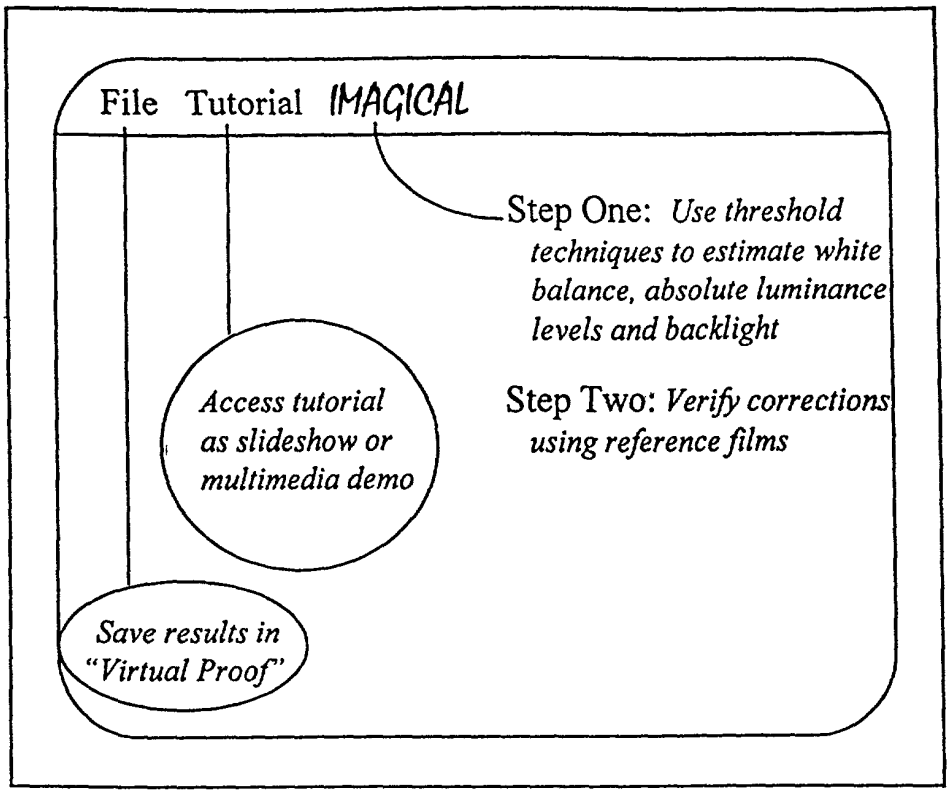
File Tutorial IMAGICAL
Step One: Use threshold techniques to estimate white balance, absolute luminance levels and backlight
Step Two: Verify corrections using reference films
Access tutorial as slideshow or multimedia demo
Save results in "Virtual Proof"

FIG. 5

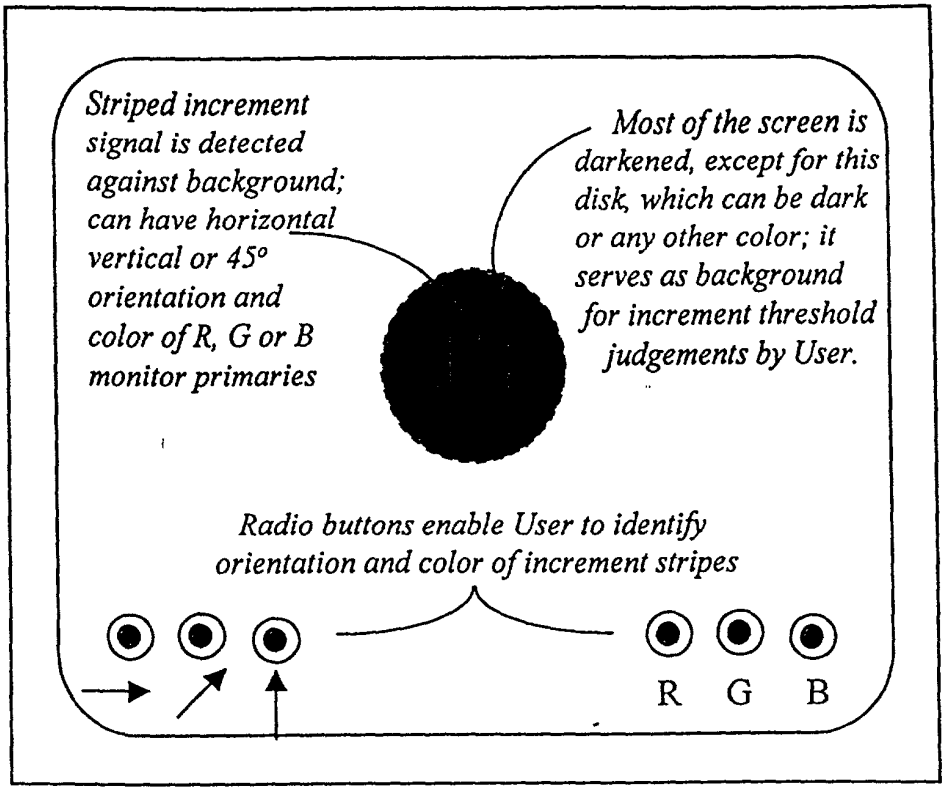

FIG. 6

US 6,454,410 B1

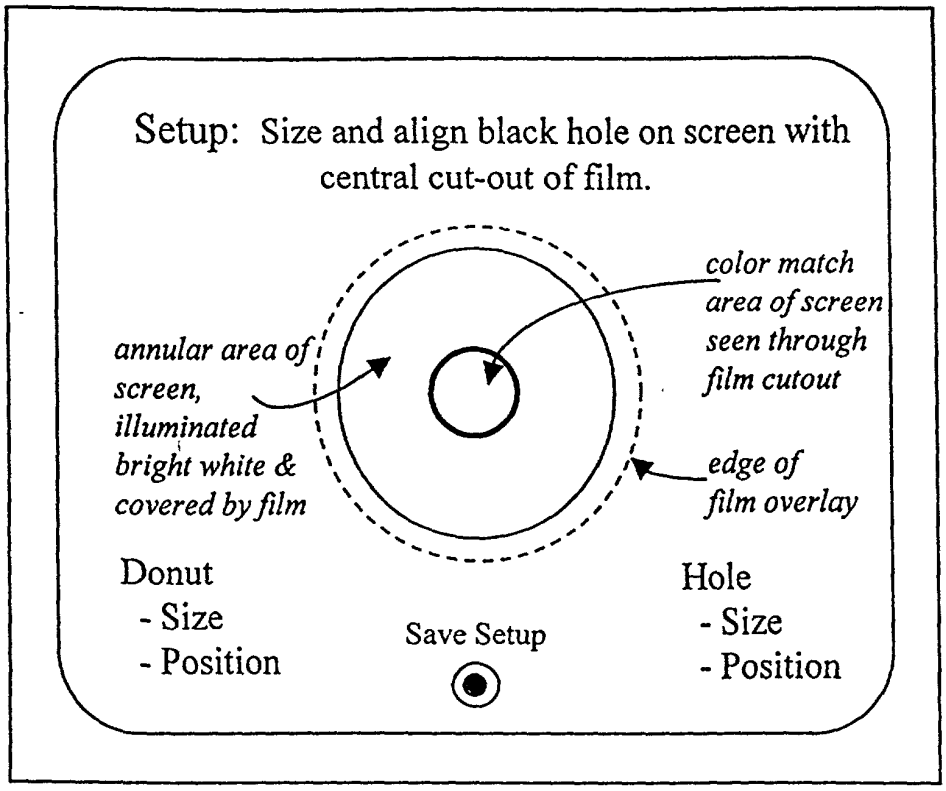
Setup: Size and align black hole on screen with central cut-out of film.
color match area of screen seen through film cutout
annular area of screen, illuminated bright white & covered by film
edge of film overlay
Donut
- Size
- Position
Save Setup
Hole
- Size
- Position

FIG. 7

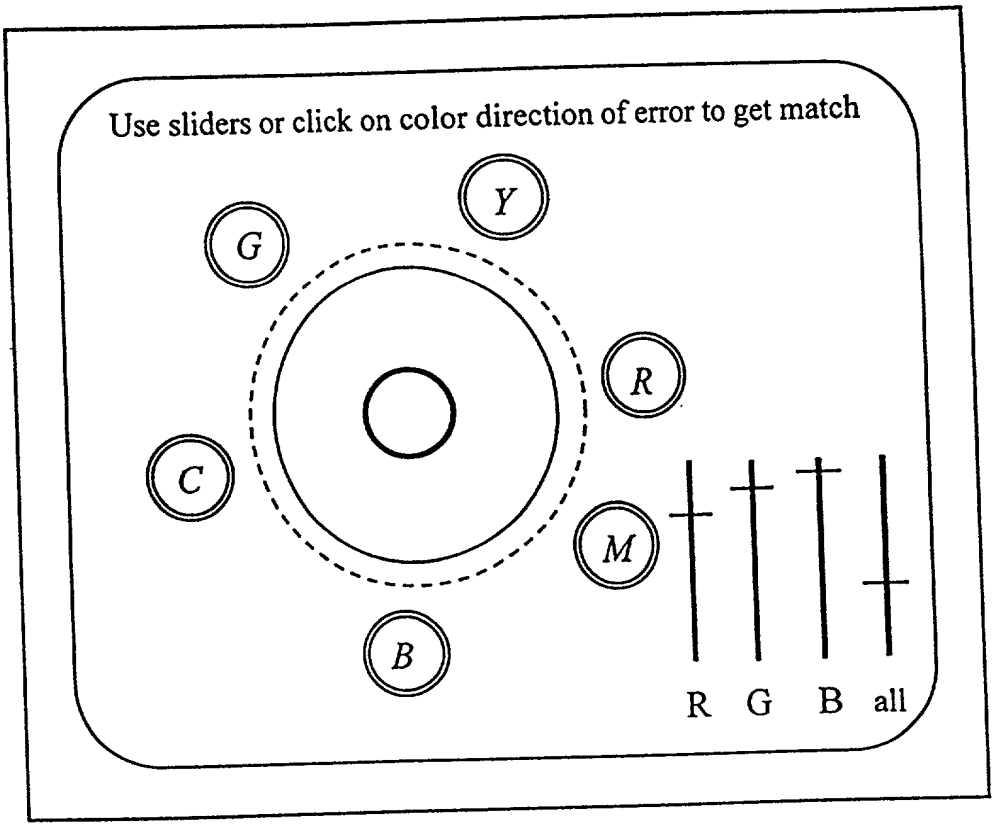
Use sliders or click on color direction of error to get match
Y
G
R
C
M
B
R G B all

FIG. 8

Prepare Normative Color-Matching Data:

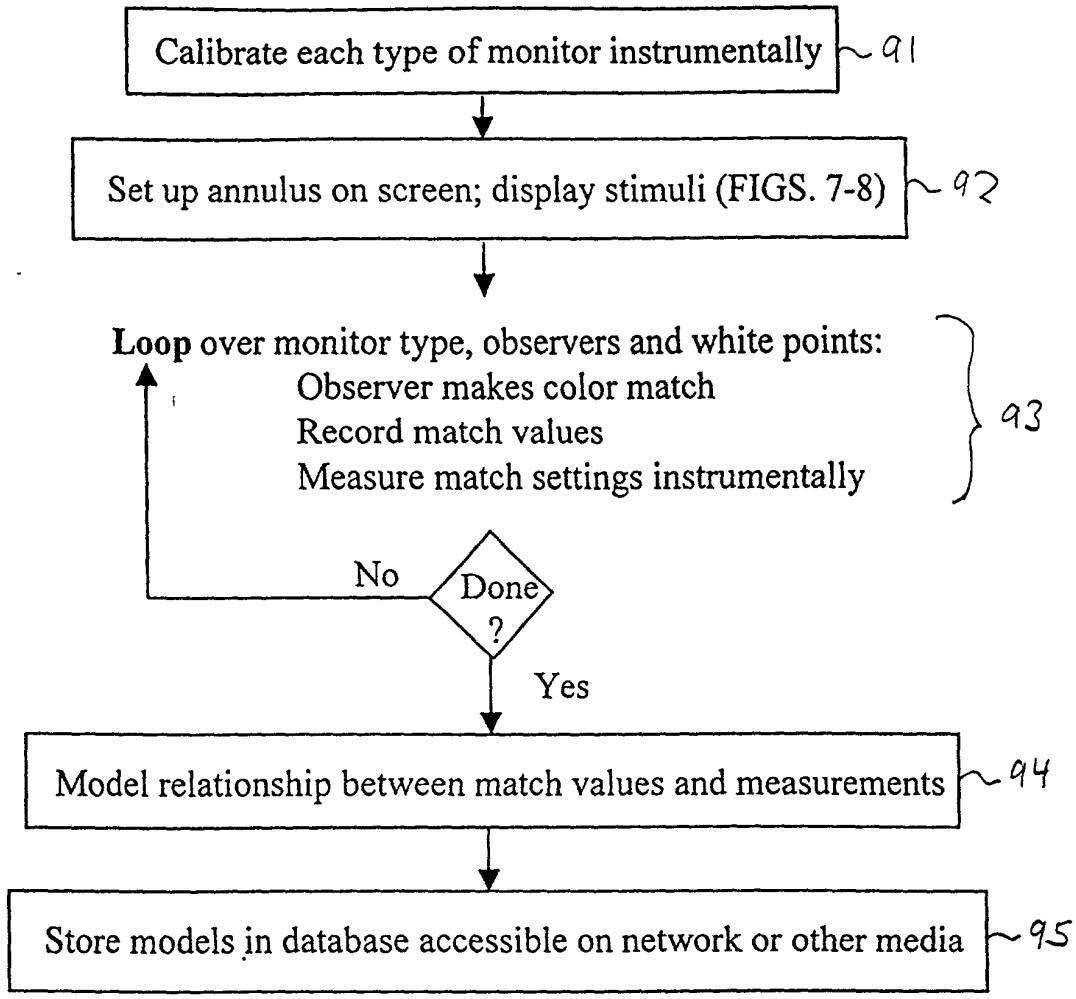

FIG. 9A

Use Normative Data in Subjective Calibration:

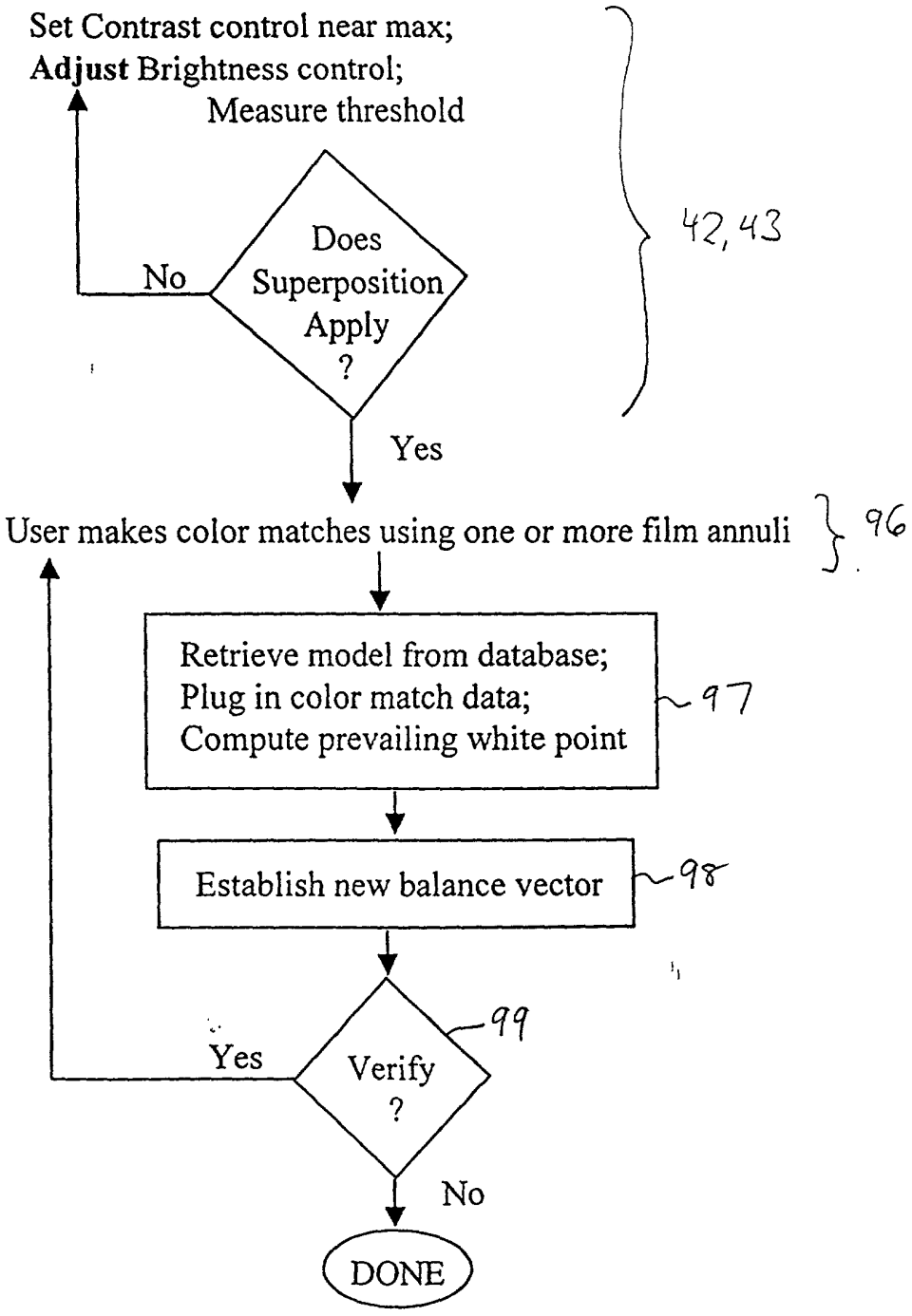

FIG. 9B

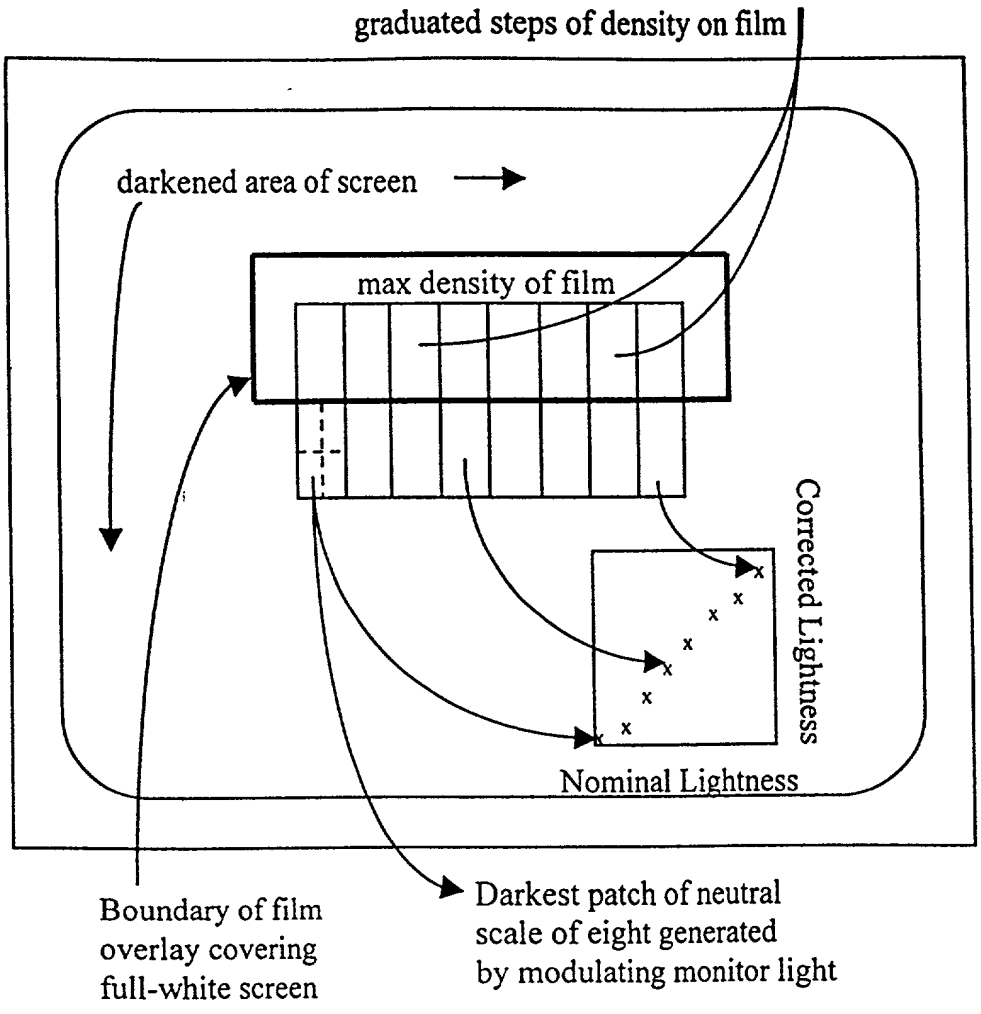
graduated steps of density on film
darkened area of screen
max density of film
Corrected Lightness
Nominal Lightness
Boundary of film overlay covering full-white screen
Darkest patch of neutral scale of eight generated by modulating monitor light

FIG. 10

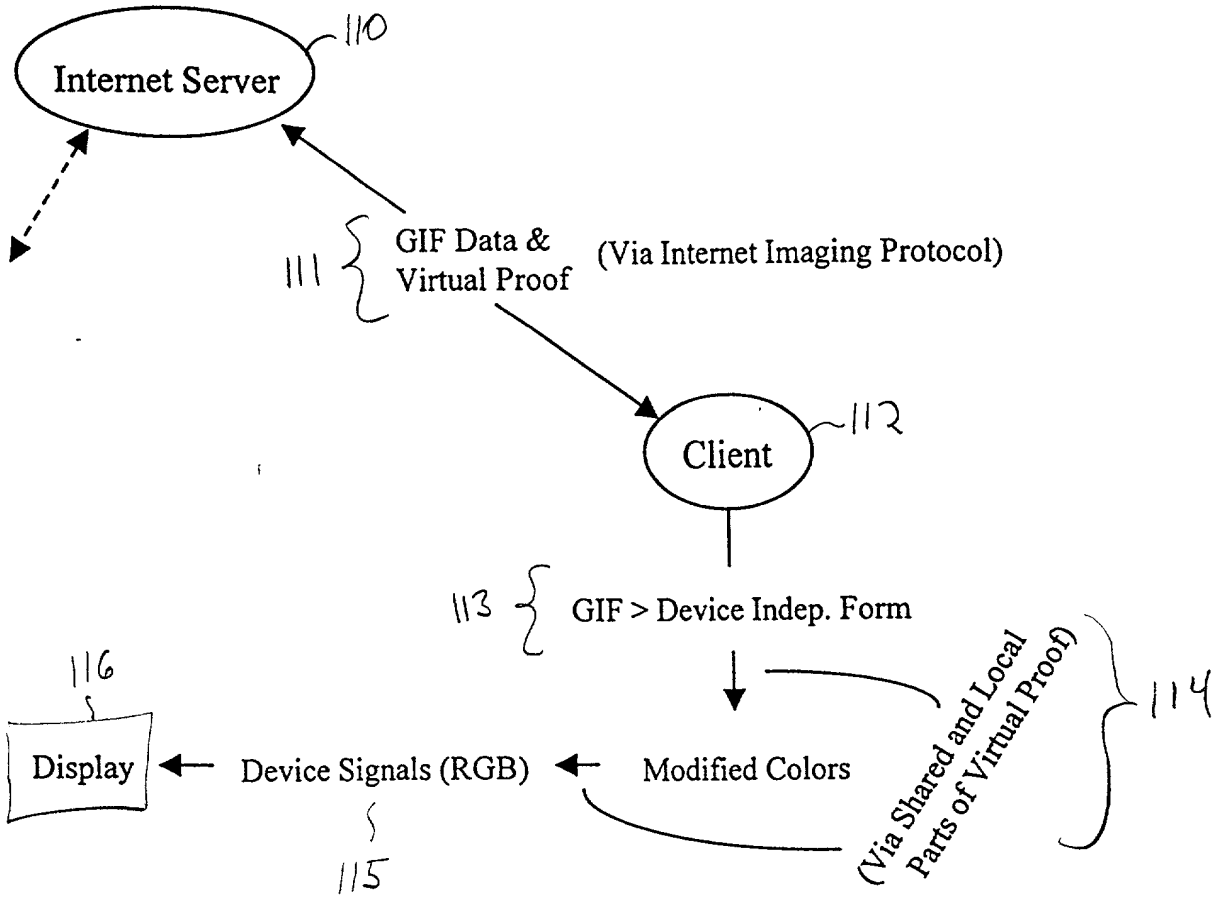
Internet Server
110
GIF Data &
Virtual Proof
111
(Via Internet Imaging Protocol)
Client
112
GIF > Device Indep. Form
113
Modified Colors
(Via Shared and Local
Parts of Virtual Proof)
114
Device Signals (RGB)
115
Display
116

FIG. 11

Rendering Decisions at Receiver:

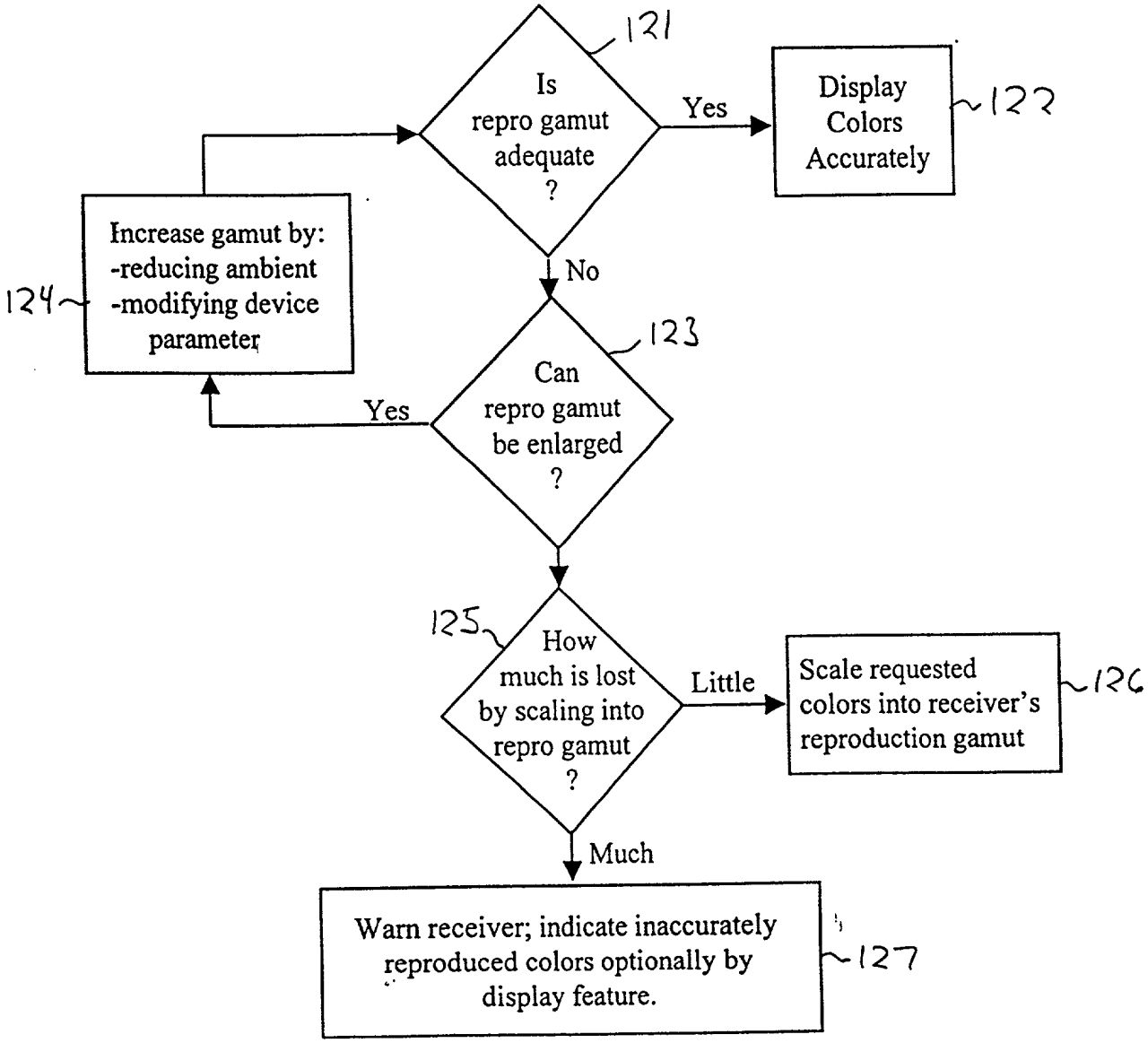

FIG. 12

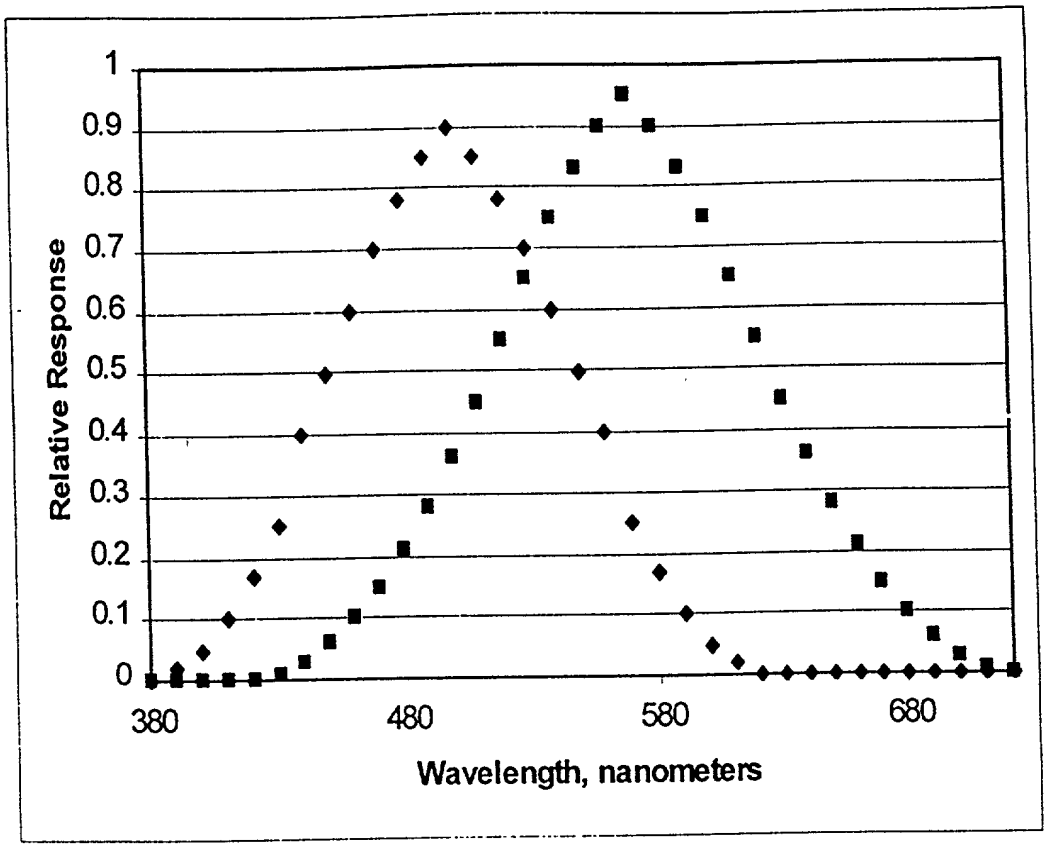
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Relative Response
380
480
580
680
Wavelength, nanometers

FIG. 13

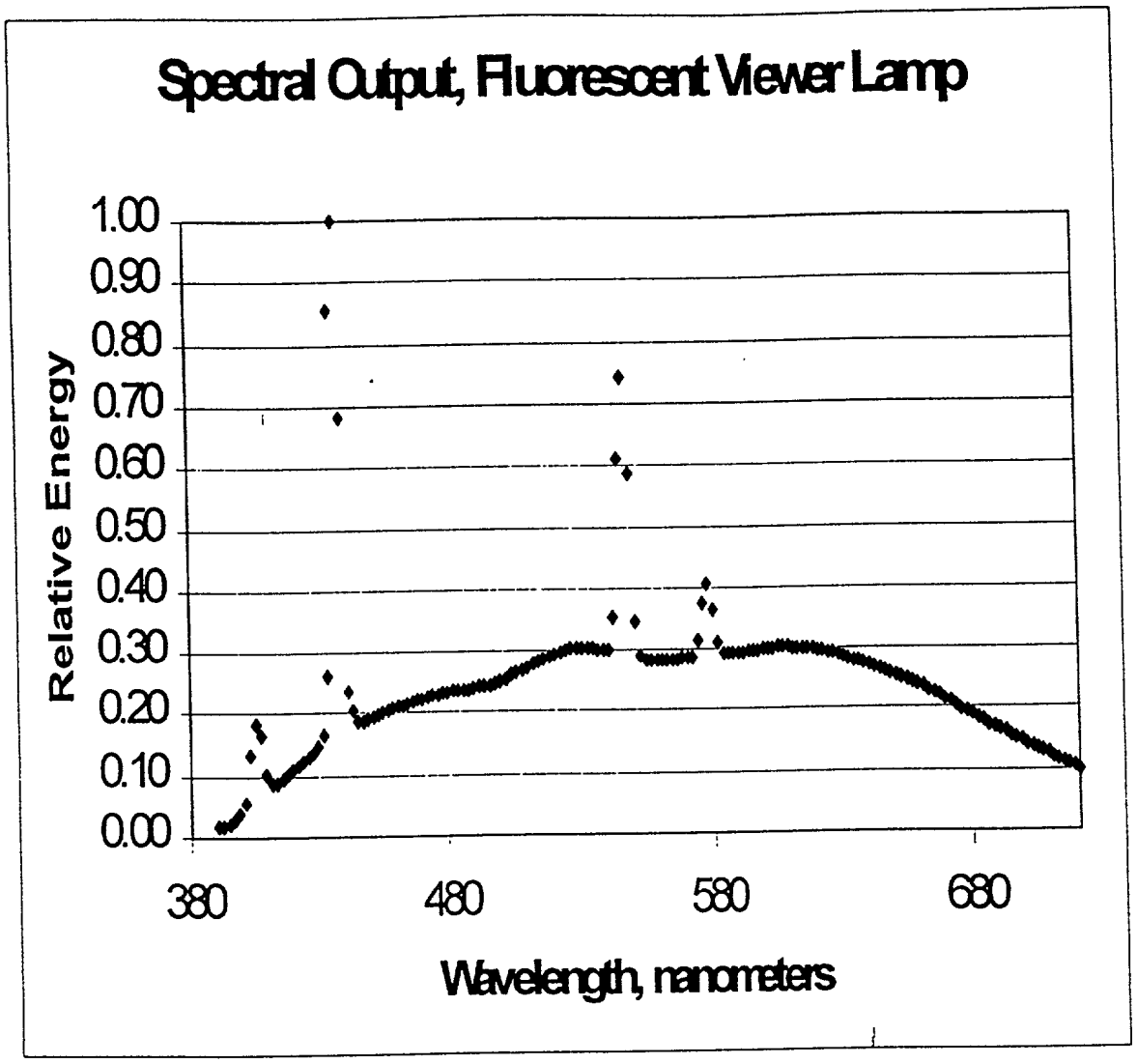
Spectral Output, Fluorescent Viewer Lamp
Relative Energy
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
380
480
580
680
Wavelength, nanometers

FIG. 14

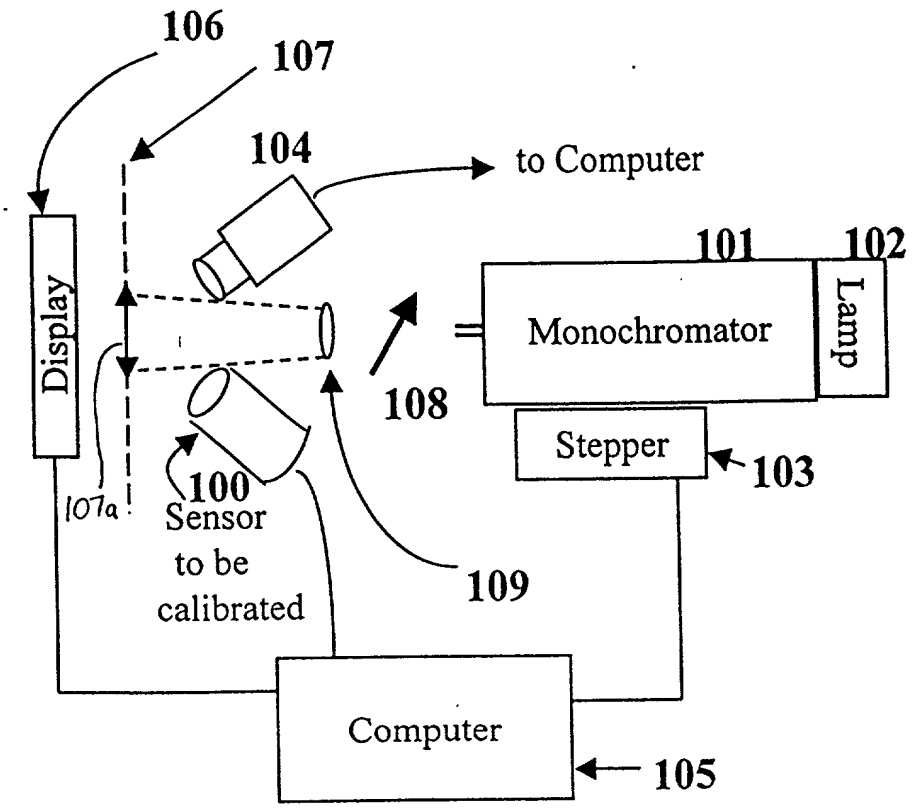
106
107
104
to Computer
101
102
Display
Monochromator
Lamp
108
Stepper
103
107a
100
Sensor
to be
calibrated
109
Computer
105

FIG. 15

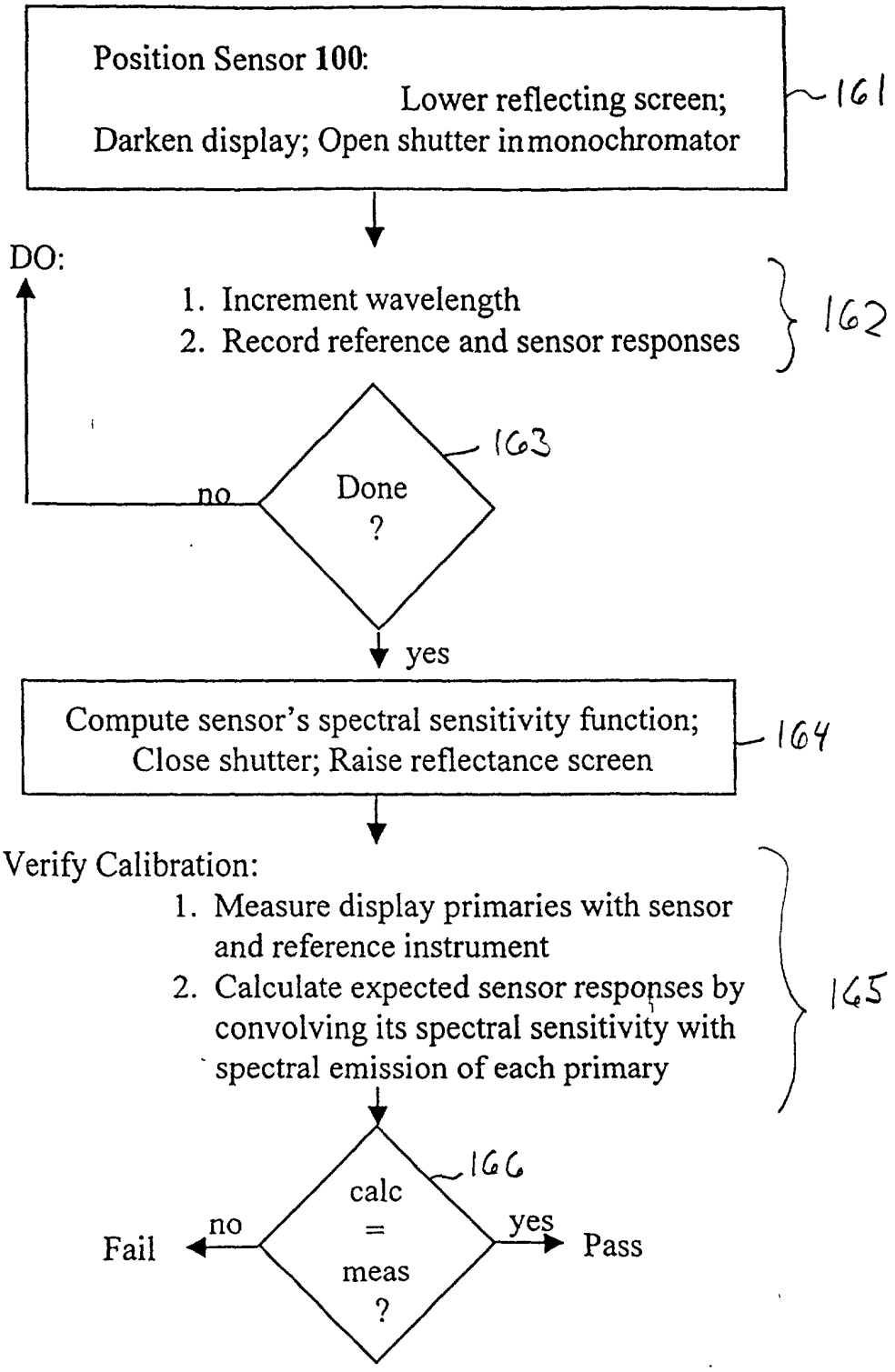
Position Sensor 100:
Lower reflecting screen;
Darken display; Open shutter in monochromator
161
DO:
1. Increment wavelength
2. Record reference and sensor responses
162
Done ?
163
no
yes
Compute sensor's spectral sensitivity function;
Close shutter; Raise reflectance screen
164
Verify Calibration:
1. Measure display primaries with sensor and reference instrument
2. Calculate expected sensor responses by convolving its spectral sensitivity with spectral emission of each primary
165
calc = meas ?
166
no
Fail
yes
Pass

FIG. 16